



C E Composites-04.US

Schedule A

to the Response the Office Action of October 4, 2005 Serial number 10/672,060

Please amended the claims of the specification to read as follows:

Claims 1-13 (Cancelled)

14. (Currently amended) A tubular baseball bat with a longitudinal axis comprising a cylindrical handle portion for gripping, a cylindrical tubular barrel portion of given length for striking, the barrel portion having a barrel wall with a sweet spot area within its length, and a tapered bridging portion connecting the handle portion and the barrel portion, wherein the barrel portion has:

- a) a distal end remote from the handle;
- b) a proximal end where the tapered portion connects to the handle portion;
- c) a mid-section within the barrel portion, the mid-section being of shorter length than the length of the barrel portion and including the sweet spot area;
- d) two lateral regions extending on either sides of the mid-section towards the distal and proximal ends respectively, and
- e) a radial stiffness for the barrel wall at each location along the length of the barrel portion,

the radial stiffness of the barrel wall being greater in the mid-section of the barrel portion than in the two lateral regions of the barrel portion [I.],

to provide a flattened batting performance over the mid-section that is flattened compared to what otherwise would exist without the presence of the greater radial stiffness in the mid-section and which is characteristic of an enlarged sweet spot.

15. (Previously presented) A bat as in claim 14 wherein the barrel portion comprises a barrel wall of polymer composite material and the polymer composite material provides a radial stiffness in the barrel wall within the mid-section of the barrel portion which is greater than the radial stiffness of the barrel wall within the lateral regions.

16. (Previously presented) A bat as in claim 15 wherein the polymer composite material contains reinforcing fibers and the reinforcing fibers are angled within the barrel wall of the mid-section to provide the barrel wall with a radial stiffness in the mid-section that is greater than the radial stiffness of the barrel wall within the two lateral regions of the barrel portion.

17. (Previously presented) A bat as in claim 15 wherein the polymer composite material contains reinforcing fibers at various angles with respect to the longitudinal axis, the reinforcing fibers present within the barrel wall of the mid-section being at a higher average angle from the longitudinal axis than the average angle of the fibers within the barrel wall of the two lateral regions of the barrel portion.

18. (Previously presented) A bat as in claim 15 wherein the polymer composite material contains reinforcing fibers of types having differing stiffnesses, and the reinforcing fibers within the barrel wall of the mid-section contain a higher percentage of fibers of higher stiffness than in the lateral regions to provide the barrel wall with a radial stiffness in the mid-section that is greater than the radial stiffness of the barrel wall within the two lateral regions of the barrel portion.

19. (Currently amended) A bat as in claim 15 wherein the barrel wall has a thickness and wherein the polymer composite material of the barrel wall is of a greater thickness within the barrel wall of the mid-section than in the lateral regions **by at least 8 1/3 %** to provide the barrel wall with a radial stiffness in the mid-section that is greater than the radial stiffness of the barrel wall within the two lateral regions of the barrel portion.

20. (Previously presented) A bat as in claim 14 wherein the barrel wall has a thickness and the thickness of the barrel wall in the mid-section is greater than the thickness of the barrel wall in the lateral regions **by at least 8 1/3 %** whereby the radial stiffness of the barrel wall in the mid-section of the barrel portion is greater than the radial stiffness of the barrel wall in the lateral regions.

21. (Withdrawn) A bat as in claim 20 wherein the thickness of the mid-section of the barrel portion is greater than the thickness of the lateral regions at their thinnest parts by at least 5%.

22. (Withdrawn) A bat as in claim 14 wherein the barrel portion has inner and outer surfaces, the barrel portion comprising a stiffener positioned along the mid-section of the barrel portion adjacent the inner or outer surface of the barrel portion, whereby the radial stiffness of the barrel wall with the stiffener present along the mid-section of the barrel portion is greater than the radial stiffness of the barrel wall in the lateral regions.

23. (Withdrawn) A bat as in claim 22 wherein the stiffener has a stiffener wall having a thickness of between .005 inches 0.040 inches.

24. (Withdrawn) A bat as in claim 22 wherein the stiffener has a length of 2 to 6 inches.

25. (Withdrawn) A bat as in claim 22 wherein the stiffener is unbonded along its length to the barrel portion.

26. (Withdrawn) A bat as in claim 22 wherein the stiffener is bonded at least partially along its length to the barrel portion.

27. (Withdrawn) A bat as in claim 22 wherein the stiffener is bonded fully along its length to the barrel portion.

28. (Withdrawn) A bat as in any one of claims 22, 23, 24, 25, 26 or 27 wherein the stiffener is located on the inner surface of the barrel portion.

29. (Withdrawn) A bat as in any one of claims 22, 23, 24, 25, 26 or 27 wherein the stiffener is located on the external surface of the barrel portion.

30. (Withdrawn) A bat as in any one of claims 22, 23, 24, 25, 26 or 27 wherein the stiffener is composed of polymer composite material which comprises a resin matrix encapsulating reinforcement fibers wherein the resin is selected from the group of resin consisting of epoxy, vinyl ester, polyester, urethane, nylon, and mixtures thereof and wherein the reinforcement fibers are selected from the group consisting of fiberglass, graphite, carbon, aramid, boron, nylon fibers and mixtures thereof.

31. (Currently amended) ~~A bat as in any one of claims 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, or 27~~ A tubular baseball bat with a longitudinal axis comprising a cylindrical handle portion for gripping, a cylindrical tubular barrel portion of given length for striking, the barrel portion having a barrel wall with a sweet spot area within its length, and a tapered bridging portion connecting the handle portion and the barrel portion, wherein the barrel portion has:

- a) a distal end remote from the handle;
- b) a proximal end where the tapered portion connects to the handle portion;
- c) a mid-section within the barrel portion, the mid-section being of shorter length than the length of the barrel portion and including the sweet spot area;
- d) two lateral regions extending on either sides of the mid-section towards the distal and proximal ends respectively, and
- e) a radial stiffness for the barrel wall at each location along the length of the barrel portion,

the radial stiffness of the barrel wall being greater in the mid-section of the barrel portion than in the two lateral regions of the barrel portion

whereby the batting performance of the bat within the mid-section is reduced from the level of performance that would exist if the stiffness of the mid-section were no greater than the stiffness within the lateral regions.

32. (Currently amended) ~~A bat as in any one of claims 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, or 27~~ A tubular baseball bat with a longitudinal axis comprising a cylindrical handle portion for gripping, a cylindrical tubular barrel portion of given length for striking, the barrel portion having a barrel wall with a sweet spot area within its length, and a tapered bridging portion connecting the handle portion and the barrel portion, wherein the barrel portion has:

- a) a distal end remote from the handle;
- b) a proximal end where the tapered portion connects to the handle portion;

- c) a mid-section within the barrel portion, the mid-section being of shorter length than the length of the barrel portion and including the sweet spot area;
 - d) two lateral regions extending on either sides of the mid-section towards the distal and proximal ends respectively, and
 - e) a radial stiffness for the barrel wall at each location along the length of the barrel portion,
- the radial stiffness of the barrel wall being greater in the mid-section of the barrel portion than in the two lateral regions of the barrel portion

wherein the radial stiffness **of the barrel wall** of the barrel portion is graduated as proceeding from a location within the mid-section of the barrel portion through to a location within the lateral regions of the barrel portion wherein the barrel wall has lesser radial stiffness than in the mid-section.

33. (Currently amended) A bat as in any one of claims 14, 15, 16, 17, 18, 19, or 20; 21, 22, 23, 24, 25, 26, or 27 wherein the mid-section has a length that is less than ~~[[50]]~~33.3% of the length of the barrel portion.

34. (Currently Amended) A bat as in 33 wherein the mid-section has a length that is less than ~~[[33.3]]~~25% of the length of the barrel portion.

35. (Currently Amended) A bat as in claim 33 wherein the mid-section has a length that is less than ~~[[25]]~~ 16 2/3% of the length of the barrel portion.

36. (Currently amended) A bat as in any one of claims ~~[[14]]~~, 15, 16, 17, 18, 19 or 20, 21, 22, 23, 24, 25, 26, or 27 wherein the bat consists of polymer composite material which comprises a resin matrix encapsulating reinforcement fibers wherein the resin is selected from the group of resin consisting of epoxy, vinyl ester, polyester, urethane, nylon, and mixtures thereof and wherein the reinforcement fibers are selected from the group consisting fiberglass, graphite, carbon, aramid, boron, nylon fibers and mixtures thereof.

37. (Currently Amended) A tubular baseball bat with a longitudinal axis comprising a cylindrical handle portion for gripping, a cylindrical tubular barrel portion of given length for striking, the barrel portion having a barrel wall with distinct locations and a sweet spot area within its length, and a tapered portion connecting the handle portion and the barrel portion, wherein the barrel portion has:

- a) a distal end remote from the handle;
- b) a proximal end where the tapered portion connects to the handle portion;
- c) a mid-section within the barrel portion, the mid-section being of shorter length than the length of the barrel portion and including the sweet spot area; and
- d) two lateral regions extending on either sides of the mid-section towards the distal and proximal ends respectively,

the radial stiffness of the barrel wall being greater in the mid-section of the barrel portion than in the two lateral regions of the barrel portion

wherein the barrel wall of the barrel portion ~~comprises~~ **consists of** polymer composite material containing reinforcing fibers at various angles with respect to the longitudinal axis, the reinforcing fibers present within the barrel wall of the mid-section being at a higher average angle with respect to the longitudinal axis than the average angle of the fibers within the barrel wall of the two lateral regions of the barrel portion.

38. (Currently amended) A tubular baseball bat with a longitudinal axis comprising a cylindrical handle portion for gripping, a cylindrical tubular barrel portion of given length for striking, the barrel portion having a barrel wall with distinct locations and a sweet spot area within its length, and a tapered portion connecting the handle portion and the barrel portion, wherein the barrel portion has:

- a) a distal end remote from the handle;
- b) a proximal end where the tapered portion connects to the handle portion;
- c) a mid-section within the barrel portion, the mid-section being of shorter length than the length of the barrel portion and including the sweet spot area; and
- d) two lateral regions extending on either sides of the mid-section towards the distal and proximal ends respectively,

the radial stiffness of the barrel wall being greater in the mid-section of the barrel portion than in the two lateral regions of the barrel portion

wherein the **barrel wall of the barrel portion** **consists of** polymer composite material **which** contains reinforcing fibers ~~of types having differing stiffnesses~~, and ~~the reinforcing fibers within~~ the barrel wall of ~~in~~ the mid-section contain a higher percentage of fibers ~~of higher stiffness~~ than in the lateral regions to provide the barrel wall with a radial stiffness in the mid-section that is greater than the radial stiffness of the barrel wall within the two lateral regions of the barrel portion.

39. (Currently Amended) A tubular baseball bat comprising a cylindrical handle portion for gripping, a cylindrical tubular barrel portion of given length for striking, the barrel portion having a barrel wall with distinct locations and a sweet spot area within its length, and a tapered portion connecting the handle portion and the barrel portion, wherein the barrel portion has:

- a) a distal end remote from the handle;
- b) a proximal end where the tapered portion connects to the handle portion;
- c) a mid-section within the barrel portion, the mid-section being of shorter length than the length of the barrel portion and including the sweet spot area; and
- d) two lateral regions extending on either sides of the mid-section towards the distal and proximal ends respectively,

the radial stiffness of the barrel wall being greater in the mid-section of the barrel portion than in the two lateral regions of the barrel portion

wherein the barrel wall of the barrel portion ~~comprises~~ **consists of** polymer composite material wherein the polymer composite material contains reinforcing fibers of types having differing stiffnesses, and the reinforcing fibers within the barrel wall of the mid-section contain a higher percentage of fibers of higher stiffness than in the lateral regions to provide the barrel wall with a radial stiffness in the mid-section that is greater than the radial stiffness of the barrel wall within the two lateral regions of the barrel.

40. (Currently Amended) A tubular baseball bat comprising a cylindrical handle portion for gripping, a cylindrical tubular barrel portion of given length for striking, the barrel portion having a barrel wall and a sweet spot area within its length, and a tapered portion connecting the handle portion and the barrel portion, wherein the barrel portion has:

- a) a distal end remote from the handle;
- b) a proximal end where the tapered portion connects to the handle portion;
- c) a mid-section within the barrel portion, the mid-section being of shorter length than the length of the barrel portion and including the sweet spot area; and
- d) two lateral regions extending on either sides of the mid-section towards the distal and proximal ends respectively,

wherein the barrel wall of the barrel portion has a thickness and the barrel wall has a thickness in the mid-section that is greater than the thickness of the barrel wall in the lateral regions **by at least 8 1/3 % whereby the radial stiffness of the barrel wall in the mid-section of the barrel portion is greater than the radial stiffness of the barrel wall in the lateral regions which is characteristic of an enlarged sweet spot.**

41. (Withdrawn) A bat as in claim 40 wherein the thickness of the mid-section of the barrel portion is greater than the thickness of the lateral regions at their thinnest parts by at least 5%.

42. (Currently amended) A bat as in any one of claims **31, 32, 36,** 37, 38, 39, **or 40** **[[or 41]]** wherein the mid-section has a length that is less than 50% of the length of the barrel portion.

43. (Previously presented) A bat as in claim 42 wherein the mid-section has a length that is less than 33.3% of the length of the barrel portion.

44. (Previously presented) A bat as in claim 42 wherein the mid-section has a length that is less than 25% of the length of the barrel portion.

45. (Previously presented) A bat as in claim 42 wherein the mid-section has a length that is less than 16 2/3% of the length of the barrel portion.

46. (New). A bat as in any one of Claims 14, 15, 16, 17, 18, 31, 32, 33, 34, 35, 36, 37, 38, or 39 wherein the barrel wall of the barrel portion has a thickness and the barrel wall has a thickness in the mid-section that is greater than the thickness of the barrel wall in the lateral regions by reason of an additional thickness, the additional thickness of the barrel wall in the mid-section over the thickness of the barrel wall in the two lateral regions being in the range 0.010 inches to 0.040 inches.

47. (New). A bat as in Claim 46 wherein the additional thickness of the barrel wall in the mid-section of the barrel portion over the thickness of the barrel wall in the two lateral regions is in the range 0.015 inches to 0.040 inches.

48. (New) A bat as in Claim 46 wherein the additional thickness of the barrel wall in the mid-section of the barrel portion over the thickness of the barrel wall in the two lateral regions is in the range 0.015 inches to 0.030 inches.

49. (New). A bat as in any one of Claims 19, 20, or 40 wherein the greater thickness within the barrel wall of the mid-section provides an additional thickness and the additional thickness of the barrel wall in the mid-section of the barrel portion over the thickness of the barrel wall in the two lateral regions is in the range 0.010 inches to 0.040 inches.

50. (New). A bat as in Claim 49 wherein the additional thickness of the barrel wall in the mid-section of the barrel portion over the thickness of the barrel wall in the two lateral regions is in the range 0.015 inches to 0.040 inches.

51. (New) A bat as in Claim 49 wherein the additional thickness of the barrel wall in the mid-section of the barrel portion over the thickness of the barrel wall in the two lateral regions is in the range 0.015 inches to 0.030 inches.

52. (New) A bat as in any one of the claims 14, 15, 16, 17, 18, 19, 20, 33, 34, 35 or 36 wherein the region of flattened batting performance over the mid-section is at least 4 inches in length extending longitudinally along the bat.

Schedule B

to the Response the Office Action of October 4, 2005 Serial number 10/672,060

Please amend the Title to read:

“TUBULAR BASEBALL BATS WITH VARIABLE STIFFNESS BARRELS”

Please amend the paragraphs of the specification to read as follows:

[0051] A first embodiment of the present invention Fig. 4 is a single wall tubular baseball bat consisting of a cylindrical handle portion 7 for gripping, a cylindrical tubular barrel portion 9 for striking or hitting, and a tapered portion **[[8]]** connecting the handle 7 and barrel 9 portions, with a thin polymer composite stiffener 18 **having a stiffener wall** located internally within the barrel portion 9 and extending longitudinally in the **mid-section**, sweetspot area 19 of the barrel length 1.

[0055] The first embodiment Fig. 4 of the present invention consists of a thin polymer composite stiffener 18 located internally within the barrel portion 9 generally in the sweetspot area 19 located in proximity to the middle or mid-section area of the barrel length 1 of a single wall tubular bat. The resultant stiffened bat results in a predetermined calculated lower performance, with a bigger (longer), **enlarged** sweetspot 19, as subsequently explained.

[0060] In Figure 10, in an example of the present invention, the combined barrel wall, with the polymer composite stiffener 18 present, is approximately twice as stiff in the center 2 inches of the sweetspot area 19 as in the 1 inch area immediately adjacent to the center or mid-section area on each side of the center area. The polymer composite stiffener 18 fiber type, fiber angles and thicknesses are designed such as to reduce the bbs from 100 to 96 in the center 2 inch area of the barrel length 1 and from 98 to 96 bbs in the 1 inch areas immediately adjacent to the center area. As a result of the present invention, the resultant typical example bat meets the lowered regulatory standard of 96 bbs with a sweetspot area 19 which has been increased by 100% (from 2 inch wide to 4 inch wide). **At the same time the regions around points A and B have been introduced into the batting performance curve of Figure 10 that were not present in the curve of Figure 9, with the more flattened portion there-between that is characteristic of an extended sweet spot.**

[0061] The first embodiment (ie. internal stiffener 18) of the present invention is particularly suited to retrofitting used bats returned by players and making them **legally** playable under a revised standard.

[0062] The thin polymer composite stiffener 18 of the present invention has a stiffener wall which is typically in the order of .005 inches to .040 inches in thickness, with a length of 2 inches to 6 inches which is typically less than 50% of the barrel length, such as $16\frac{2}{3}\%$ of the barrel length, as is apparent from Figure 10. A 4 inch stiffener, as referenced in paragraph [0059], in a 12 inch barrel as referenced in Figure 10, would represent 33.3% of the barrel length; a 4 inch ~~stiffner~~ **stiffener** in a 16 inch barrel would represent 25%, and a 2 inch ~~stiffner~~ **stiffener** in a 16 inch barrel would represent 12.5% of the barrel length. The stiffener 18 is preferably bonded, fully or partially, to the main member 16, or to the secondary member insert 13 of Fig. 7 or to the secondary member sleeve 14 of Fig. 8, or combinations thereof on either the internal or external barrel walls, as shown in Figures 4, 5, 7 and 8. Analogous to Figures 4, 5, 7 and 8 an alternative solution (since stiffness is proportional to thickness) to the stiffener 18 is to vary the barrel thickness 6 to the same extent and manner along any portion of the barrel length 1 of any bat according to the invention, including the bat of Figure 6, in order to vary bat performance. The barrel portion's effective wall thickness in the mid-section can be greater by ~~[[5%]]~~ **$8\frac{1}{3}\%$ or more** over the thickness of the barrel in the lateral, adjacent portions. Conversely, the barrel wall's thickness beyond its central portion, in the lateral regions proceeding towards the end portions of the barrel, may be at least ~~[[5%]]~~ **$8\frac{1}{3}\%$** thinner than the thickness of the barrel wall in the mid-section. **Just as the stiffener wall may be typically in the order of .005 inches to .040 inches in thickness, or .010 inches to .040 inches in thickness, or .015 inches to .040 inches in thickness, or 0.015 inches to 0.030 inches, so too the analogous increase in barrel wall thickness along the mid-section may fall within the same ranges.**

[0064] A third embodiment of the present invention Fig. 6 is a single wall tubular polymer composite baseball bat which in accordance with the present invention has a localized area of fiber type **of greater stiffness** and/or angle change 20 resulting in increased radial stiffness generally in the sweetspot area 19 located in proximity to the middle area of the barrel length 1. This embodiment applies equally well to double-wall and multi-wall (more than two walls) tubular all polymer composite baseball bats and is limited to newly designed polymer composite single wall, double-wall, and multi-walled new bats as opposed to field returned bats. The fiber types, and/or fiber angles, and/or fiber sizes, and/or composite thickness can be designed such as to graduate the radial stiffness of the barrel wall within the barrel portion 1 along its entire length. That is, the radial stiffness could be highest in the peak performance area (generally the sweetspot area 19) and gradually changing in uniform increments proceeding towards the barrel ends.